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bles can be conveniently read for committing to memory without haste or delay. Dr. Schumann observed: (1) That when the drum was going too rapidly and he set the rate to reduce it to the normal speed, this latter then seemed too slow; (2) that if the subjects were mentally tired the normal speed seemed unusually fast, while if they were fresh it seemed slower than usual. They are both due to the carrying over of mental impressions to changed conditions; when the drum is going a little too fast it takes a greater strain of the attention to follow the syllables; a lessening of this strain seems by contrast to reduce the speed more than it really does. So when tired we interpret difficulty of keeping the attention as increase of speed of impressions. So in time experiments in passing from one normal interval to a longer the second seems unusually long, and vice versa; we seem to have a time (.7 seconds) in which impressions are conveniently attended to. When they come more rapidly we have to strain the attention to follow them; when more slowly we have to wait for them. A similar fact was observed in the motor field. If one hand moves over a normal space of 20 cm. and the other hand moves over a space of 17, 18, 19, 20, 21, 22, or 23 cm., to judge which is longer, then in moving over a space of 23 cm. the hand will frequently move rapidly the first 20 cm. and then slowly, the space moved over seeming unusually long. Here a certain motor innervation is ready and if exceeded makes the space seem unusually long. More extended observations are in progress.

*Zur Lehre von der Willensthätigkeit.* J. ORSCHANSKY. *Archiv für Anat. u. Phys.* 1889. *Phys. Abth.*, 3-4, p. 173.

What is the nature of the difference between the two distinct kinds of exercise of the will,—the act of impulse and the act of inhibition? Is the one a setting free of energy, the other a storing of it up (Wundt)? Do they take place in different parts of the nervous system (Sietschenow)? Is it a case of simple interference of waves (Cyon)? Do these waves proceed in different directions (Goltz)? Does the struggle between the two take place in the nerve-center, the nerve or the muscle; or is the suppression of the action of one set of muscles brought about by the action of the antagonistic set (Munk)? This latter view seems plainly untenable on account of the fact that some muscles, as those in the region of the N. faciales, have no antagonists. The experiments of Orschansky were performed on the M. masseter on account of its being among the autonomous muscles, strong, of constant attachment, and admitting of easy registration of its action. They seem to show that the reaction-time of inhibition does not differ, after a brief period of practice, from that of the direct impulse. But the reaction-time of the impulse consists of four moments: (1) The passage to the sensory center, (2) the sense-perception, (3) the act of will, (4) the motor impulse; and it would be very improbable that the reaction-time of the inhibition should be wanting in any of these stages and should still be of the same duration. Moreover, very different reaction-times were obtained by varying, separately, the tension and the amplitude of the muscular excursion, and in every case the change in the inhibition-time follows closely upon the change in the impulse-time. (The author's explanation of the seemingly anomalous effects produced by these two moments does not seem to be very clear.) The effect of pathological conditions is also the same upon both. From this it seems natural to conclude that the anatomical circuit is the same for both species of exercise of the will.

C. L. F.

*Untersuchungen über die Empfindlichkeit des Intervallsinnes.* IWAN SCHISCHMÁNOW. *Philosophische Studien.* Bd. V., H. 4.

Schischmánow subjects the entire problem of the sensibility to intervals of tone to a thorough and independent re-investigation. He pre-

faces his account of his results with an interesting historical introduction, forming an admirable résumé of the topic. His own experiments consist in setting a movable weight upon a tuning fork, so that the resultant tone forms just a given interval with a constant fork; and, again, in finding the point at which the falsity of the interval is detected above and below. He then groups and averages the results, expressing the sensibility as the just perceptible portion of a vibration per second from the true interval. For Schischmánow, who is musical, and a fellow student K., who is not, the results for the different intervals thus expressed are: *Octave* (2:1), S 0.220, K 0.356; *Fifth* (3:2), S 0.332, K 0.374; *Fourth* (4:3), S 0.419, K 0.403; *Third* (5:4), S 0.485, K 0.559; *Major sixth* (5:3), S 0.502, K 0.506; *Second* (9:8), S 0.548, K 0.716; *Minor third* (6:5), S 0.607, K 0.640; *Minor sixth* (8:5), S 0.672, K 0.740; *Minor seventh* (9:5), S 0.678, K 0.763; *Major seventh* (15:8), S 0.861, K 0.902. While practice and individual differences play some part, the order as presented by Schischmánow, especially for the four best and the three worst appreciated intervals, may be taken as normal, and agrees very well with the order determined by Helmholtz, on the basis of the relative consonance of overtones, though Schischmánow does not regard this as the sole factor in the sensibility.

*Die Seelenthätigkeit in ihrem Verhältniss zu Blutumlauf und Athmung.*  
Prof. Dr. ERNST LEUMANN. Philosophische Studien. Bd. V, H. 4.

This "lay" contribution is suggestive rather than positive, its object being to call attention to the desirability of noting pulse and respiration rates in connection with psychometric determinations. The failing of words to speak, as well as power to speak them, when out of breath, or physically weary, the slowing of pulse and respiration in drowsiness and sleep, illustrate the general relation in question. As suggesting the kind of relation experiment may establish, Prof. Leumann found in one subject a pulse of 77 when scanning at the rate of 113 feet per minute, and 83 when scanning 140 per minute. Of two gymnasium students, one with a pulse of 85 read 107 feet per minute normally, another with a pulse of 98 read 129 feet per minute. In a rather more accurate test the pulse rate was found to increase as the rate of reading increased. If pulse and respiration rate were noted, we might explain small variations now regarded as accidental. Again Prof. Leumann brings the pulse rate into relation with association times, with the indifference point in the time sense, and the respiration time into relation with the waves of attention, *i. e.*, the periods in the appearance and disappearance of a very faint sensation, but the relation is only a distant analogy. It would be interesting to know whether the waves of attention are larger in slow breathers than in rapid breathers, and so on.

*Recherches sur les mouvements volontaires dans l'anesthésie hystérique.* A. BINET. Rev. phil., Nov., 1889.

Binet continues his interesting studies in hysterical hemianæsthesia, this time reporting experiments on voluntary motion. By the use of the dynamometer and the dynamograph he has compared the voluntary movements on the sound and diseased sides in respect to intensity and duration, and by reaction-times as to rapidity. The following are the general results found in the case of the subjects on which he worked, for which, of course, he does not claim universality. Two types of activity can be traced, one generally found on the sound side, the other generally on the anæsthetic. The curves representing the first type differ from those representing the second in their greater height and their more rapid rise and descent. In that type also the reaction-time is shorter. Fatigue, however, appears more quickly, betraying itself by irregular respiration and tremors in the acting member. This last is in marked